

Application No. 10/604,323

Amendment dated July 22, 2005

Amendment made in response to Office Action dated April 22, 2005

REMARKS AND ARGUMENTS

Status of Application

Claims 1-22 are pending in the present application. Claims 10-17 and 22 are withdrawn from consideration without prejudice. Claims 4-5 and 8-9 are rejected under 35 USC § 112, first paragraph, as failing to comply with the enablement requirement. Claims 1, 2, 6 and 18-21 are rejected under 35 USC § 102(e). Claim 3 is rejected under 35 USC § 103(a) as being unpatentable. New claims 23-37 have been added by way of this response.

Rejection under 35 USC §112

Claims 4-5 and 8-9 are rejected under 35 USC § 112, first paragraph, as failing to comply with the enablement requirement. In particular, it is not understood how a barrier stack of claims 4 and 8, which is a portion of a capacitor structure, can comprise a plurality of memory cells. Applicants, in response, have amended claims 4 and 8 to more clearly recite the invention. Applicants submit that the rejection under 35 USC § 112, first paragraph has been traversed and request its withdrawal.

Rejection under 35 USC §102(e)

Claims 1, 2, 6 and 18-21 are rejected under 35 USC § 102(e) as being anticipated by Yokoyama et al. (US Patent No.: 6,313,539). Applicants respectfully disagree.

Amended claim 1 and newly added claims 36 – 37 recite a barrier stack having first and second sub-barrier layers having grain boundaries and formed from first and second sub-barrier conductive materials, respectively. The second sub-barrier is disposed above the first sub-barrier layer. Passivating elements are provided to passivate grain boundaries on the upper surface of the first sub-barrier layer. By passivating the grain boundaries on the upper surface, improved barrier properties is achieved.

The portion of Yokoyama et al. to which the Examiner refers in the Office Action describes a lower electrode stack of a ferroelectric capacitor of Pt/IrO₂/Ir/TaSiN. The TaSiN is a barrier metal

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layer while the Ir and IrO₂ films are provided in order to prevent the barrier metal from oxidation in a high temperature oxygen atmosphere. The Examiner equates the TaSiN to the first conductive barrier layer (now first sub-barrier layer) and the IrO₂ to the second conductive barrier layer (now second sub-barrier layer). Applicants submit that this still fails to teach or suggest the invention as claimed. In particular, no passivating elements are provided to passivate grain boundaries of an upper surface of the first sub-barrier layer (TiSiN) as recited in claim 1. In fact, no passivating elements are provided for any of the layers of the lower electrode stack. Applicants therefore submit that claims 1, 36 and 37 are patentable over Yokoyama et al. Since claims 2-9, 18-21 and new claims 23-35 are directly or indirectly dependent on claim 1, these claims are also patentable. As such, Applicants respectfully request withdrawal of the rejection based on 35 USC § 102(e).

Rejection under 35 USC §103(a)

Claim 3 is rejected under 35 USC § 103(a) as being unpatentable over Yokoyama et al. (US Patent No.: 6,313,539) in view of Yamamichi (US Patent No.: 6,292,352) or Kuo (US Patent No.: 6,303,433). Applicants respectfully disagree.

As discussed above, Yokoyama et al. fails to teach or suggest providing passivating elements to passivate grain boundaries on an upper surface of the first sub-barrier layer. The Examiner relies on Yamamichi or Kuo only to teach that the plug has a step over an ILD layer. See Office Action dated April 22, 2005, pages 4-5. Even if this were true, this still fails to compensate for the deficiencies of Yokoyama et al. Applicants therefore submit that all pending claims are patentable over Yokoyama et al., Yamamichi and Kuo, alone or in combination and respectfully request withdrawal of the rejection based on 35 USC § 103(a).

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Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance and the issuance of a formal Notice of Allowance at an early date is respectfully requested.

Should the Examiner believe that a telephone conference would expedite prosecution of this application, please telephone the undersigned attorney at his number set out below.

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Respectfully submitted,


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